DOCUMENT RESUME

ED 258 395 EC 172 915

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TITLE Keys to the World: A Brief Examination of Microcomputer Technology for Telecommunications.
PUB DATE Feb 85
NOTE 55p.; Paper presented at the Annual Convention of the Association for Children and Adults with Learning Disabilities (22nd, San Francisco, CA, February 20-23, 1985). Poor type will affect legibility.
PUB TYPE Speeches/Conference Papers (150) -- Reports - Descriptive (141)

EDRS PRICE MF01/PC03 Plus Postage.
DESCRIPTORS Computer Software; *Disabilities; Elementary Secondary Education; Information Networks; *Microcomputers; *Rural Areas; *Telecommunications; *Telephone Communications Systems
IDENTIFIERS *Rural Special Education Outreach Project

ABSTRACT

The paper examines several applications of telecommunications processes with handicapped persons, specifically telephone-based data communication systems. The functions of computer components--a microcomputer, modem, printer, and software--are described in terms of communication efficacy. Commercially available information bases are noted, as is the function of the Rural Special Education Outreach Project of the University of Lethbridge (Alberta, Canada). RSEOP is a customized bulletin board system featuring such telecommunications applications as electronic mail; consultation services between participants, university personnel, and the information utilities; and electronic conferencing between system participants. Hardware components of the RSEOP are described. Problems associated with microcomputer telecommunications are noted, including difficulties over equitable access and an anti-innovation stand commonly found in the professional education community. Projections for RSEOP to expand into reflexive communication, preschool intervention, and precision teaching are considered. (CL)

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Microcomputer Telecommunications

Keys to the World -
A Brief Examination of
Microcomputer Technology for Telecommunications

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KEYS TO THE WORLD - A BRIEF EXAMINATION OF MICROCOMPUTER TECHNOLOGY FOR TELECOMMUNICATIONS

In the network environment rewards come by empowering others, not climbing over them.

- Naisbith/Megatrends

Introduction and Limitations - The (Intra)Personal Computer Becomes Interpersonal

This article will focus on the general application of microcomputer technology enhanced by data communication processes. The effectiveness of computer-based instruction (CBI), computer-assisted instruction (CAI), and computer-managed instruction (CMI) for special needs students has attracted much attention in the past decade. These three areas of service, CBI-CAI-CMI, are already well documented as powerful teaching and support agents enhancing the learning processes of special needs children. It is widely accepted that the primary factor responsible in restricting the full utility of established technological achievements for the handicapped are the limits of our imaginations and the extent of our moral commitment to advocate on their behalf. The interface

of advanced computer technology, and advanced conceptions of how individuals learn, is enabling a fresh insight into the "handicapped" learner as a remarkable learner whose potential has been untapped by traditional methodology.

The recent avalanche of publications acts as one testimony to the firm foothold that microcomputer utilization has gained in the field of special education. Journals such as Byte, Exceptional Children, and Special Services in the Schools have published special issues on the topic. Specific journals, such as the Journal of Special Education Technology, are now dedicated to the issue. The influential Closing the Gap agency in Minnesota delivers its primary publications, and conducts national conferences, on the use of microcomputers in special education. Primary references are now appearing, of which Handbook of Microcomputers in Special Education (Behrmann, 1984), Microcomputer Resource Book for Special Education (Hagen, 1984), and Microcomputers in Special Education (Taber, 1983) serve as exemplars. Each of these examples has considered

one or more dimensions associated with microcomputer telecommunications as an emerging breakthrough in technological application.

Article after article argues for the achievement of what one author (Tabor, 1984) identified as the five significant freedoms accruing to special educators, and the individuals for whom they advocate, through the effective use of technology. Four of these refer to the efficient/effective use of time, the enhancement of learning processes and outcomes, the achievement of greater environmental independence, and meaningful involvement in gainful employment.

The most important freedom achieved, to this author's bias at least, is the freedom to communicate, because of the major impact communication skills have upon self-esteem. Stand-alone microcomputers, enhanced by peripherals such as speech synthesizers, enable the handicapped to share thoughts: a major freedom in itself. Recent developments in peripheral technology, such as Autospeak (a text-to-speech synthesizer which allows a speech impaired person to pre-enter as many as thirty-two sentences and direct these at will to a speech synthesizer) and the Cacti Communication Program (which enables the printing of words/phrases on the

screen or printer with a minimum number of key presses) serve as examples of liberating technology. Such facilitative devices, if linked together through a telecommunications network, greatly enhance communication freedom because the boundaries of space and time can be overcome.

Telecommunication processes enhanced by microcomputer technology offer a major area of special education service which could revolutionize concepts of schooling and education for many. For example, electronic bulletin boards now give teachers and parents overnight and inexpensive access to qualitative curriculum strategies validated elsewhere with special needs children similiar to their own. Subscription data services (eg. Specialnet) allow subscribers to access large specialized libraries of information, and the luxury of electronic mail to react to content as well as to raise issues excluded from content. Literally, our social boundary has extended from "chatting over the back fence" to one where no fence exists apart from the limitations imposed by motivation, time, and the subscription rate incurred for access.

Even more dramatically, the school without walls concept is enabled by the application of computer-generated/telephone-delivered instruction from a knowledgeable source to populations previously isolated by age, severity of handicap, and physical distance. An examplary model, the Kentucky Project (Tawney, Aeschleman, Deuton & Donaldson, 1979) established a prototype delivery system to reach severely developmentally delayed and multiply-handicapped pre-schoolers in their homes.

If the limitations of traditional school practices can be overcome with such low-incidence heterogeneous populations, what are the normalization and integration implications for all children, not just those severely isolated geographically and emotionally from the mainstream?

This article will attempt to provide a brief exposure to several of the present applications of telecommunication processes and provide a simplified explanation of operational components. It will conclude with a focused description of a small-scale electronic network and bulletin-board system developed by the Rural Special Education Outreach Project (RSEOP) of the University of Lethbridge (Alberta, Canada).

It will be limited to a discussion of telephone-based data-communication systems which differ somewhat from LAN's ("local area networks"). LAN's are generally building or campus-based networks which provide powerful communications features for computers in relatively close proximity. Telephone-based systems are usually limited to normal two-party interchanges but they can be enhanced in service potential and can literally span the globe.

A Brief Overview of Telecommunication Processes

Communication is one of man's most significant processes, primarily because it enhances the capacity and extension of intelligent and social interchange. Inefficient/ineffective or non-existent communication skills isolates and restricts the power of intellect. Further, the interpersonal exchange of intrapersonal thought [illegible] both enhance social affiliation and catalyze the learning process by providing a medium for the embellishment of concepts.

Traditional print mediums have served some 5,000 years to bring knowledge to an information-hungry world. Contemporary examples include the colloquial

knowledge of newsprint and the scientific tomes of a myriad of research communities.

Today, the emergence of the global village is facilitated through an electronic extension and enhancement of traditional communication systems, a privilege enjoyed primarily by the business and technical communities. Communication media thought visionary in mid-century is now a pragmatic reality, as microwave transmission, fibre optic relays, videotex/teletext, satellite broadcasting, cable exchange, teleconferencing, and computer subscription services reveal.

Relatively unsophisticated computer users are able to participate in the global village through the use of "modems" and other peripheral devices which incrementally enhance the powerful stand-alone capacity of a central processing unit by enabling it to share and to interact.

That technological advancements will increase exponentially is obvious; maximum "user-friendliness" and utility will convert present exotic applications to plebian usage. Photo-digitizers, voice recognition units, and speech sythesizers will be integrated and improved to the point that standard keyboards may well

ecome obsolete and thereby remove one of the larger
bstacles to mass computer interaction. Many
hysically handicapped individuals, as well as the
ensorily-impaired, are presently seeing a positive
chnological impact on their independence as a result.

Unfortunately, the scientific and business
ommunities embrace technological innovation with a
assion that general educators in the public domain
iew both with alarm and envy. One exception is
oteworthy at this point: that sector of public
ducation known as" special education", perhaps because
f the pressing and massive needs of its human charges,
as appeared to have discovered in technology the most
owerful normalizing and integrating agent yet devised.

It is worth repeating that CBI-CAI-CMI
pplications with special needs populations are
owerful normalizing agents if carefully utilized and
onitored. Equal care in establishing a network of
uch microcomputer applications adding the power of
elected peripheral devices can be expected to enable,
nhance, and empower the process of communication.

Essentially, the acquisition of hardware (modems,
coustic couplers) and appropriate communications
oftware enable the "intrapersonal" computer to become

"interpersonal". Acquiring and disseminating information becomes a universal opportunity, provided that advocates for the handicapped demand equity in the distribution and utilization of the requisite technology.

As one prominent special education advocate has suggested:

> For the first time, the handicapped will have equal access to that information. This will give them an equality of opportunity never before available. The blind will never be restricted to someone else's choice of literature, the hearing impaired will be able to communicate with anyone over great distances, and the physically handicapped will have access to any information they choose from their wheelchair. Telecommunications via the microcomputer will, for the first time, give the handicapped equal opportunity in society. (Kagen, 1984, p. 9)

This attitude was also addressed with reference to the specific needs of physically disabled -

communication, computer access, environmental control and mobility.

> Of the four areas, communication is by far the most important ... the level of achievement reached is closely tied to the ability to communicate. The more effective a person's communication skill, the further that person may be expected to go in life.
>
> The transition to an information based society is a boon to people with physical handicaps ... A physical handicap doesn't have to affect a person's ability to access, process and communicate information. Today, no person should be provided with a communication system, environmental control or powered wheelchair without consideration for access to computers. (Romich & Vagnini, 1984, p. 71-72)

Further, Behrmann addresses a related question of the equitable access to, and sharing of, information made possible by networking. He defines networking as "a computer-controlled system for managing information across locations" (Behrmann, 1984, p. 253). Networking also permits the sharing of peripheral devices and

software, leading to greater participation by all in applications such as teleconferencing and electronic publication. Behrmann (1984) comments:

> The concept of networking is a major step toward breaking down barriers to the education of handicapped children. Networking fosters professional development, professional communication, accessibility and integration of information and human resources, and direct individualized interactive student instruction regardless of possible geographic or physical limitations. Finally, it offers the opportunity to extend school services to the home environment and facilitate parent-school communication and interaction (p. 253).

Thus, "interpersonal" microcomputers, accessing and enhancing information banks and communicating (electronically but not necessarily impersonally), should generate excitement in the special education community if not elsewhere in public education. The science of "telematics" (Brennant Sniggs, 1984) is emerging to describe the hardware, software, network and content which indicate that microcomputer

networking has gained academic recognition if not full stature as a field of note. New terms describing the emerging lexicon of electronic communication - image grammar, mediatrics, telematics, and the like - demonstrate the arrival of the area as an applied endeavor worthy of further pursuit.

Keys to the World - Initiating the Process

Assuming one wishes to apply the benefits of computer-based communications as an advocate for special needs individuals, then a small number of cost-effective hardware items (specifically, a microcomputer and modem; ideally a printer as well) and "terminal" or "communications" software must be acquired.

The function of each will be reviewed at this point.

Hardware and Software Essentials

The microcomputer is simply an information manager. Its' impressive functional ability can be extended dramatically. Relatively "dumb" stand-alone units become "smart" interactive terminals by the addition of appropriate terminal software. The

essential supplementary requirements which beg explanation include communications software, word processing software, modems, and serial interface cards.

The communications software, as the "information choreographer," is simply the set of computer instructions (i.e. program) which determines how the microcomputer should process the information it receives or transmits. It is the crucial component to the effective use of a microcomputer as a telecommunications device. Regardless of your specific microcomputer model, barring memory requirements, your software choice will directly affect the flexibility and ease of communication. Just as all telephone formats (eg. regular, memory-phone, cordless, radio-telephone or PBX exchange) all essentially provide the same audio communications, each type is designed to meet specific requirements. This is true for computer based communications software as well. Therefore, one should insure that the software package selected has the features desired. It is often the case that selection of a software package will determine the type of hardware configuration required to implement those features.

Software functions which are very basic include the ability to transfer information to and from a storage medium such as a diskette. This key feature enables the user to tap into information sources and capture the resulting communications onto a diskette for future reference. The most common information transfer involves the retrieval of text files which may be easily accessed and modified using one of the many text word processors such as Applewriter or Screenwriter. The reverse is also possible, as messages may be prepared in advance using a word processor and then transfered to another computer using the communications software.

The capture-to-disk and send-from-disk feature allows information to be transfered at the maximum rate that the computer can transfer (defined as the baud-rate). Most modems (described below) transfer data at either 300 or 1200 baud, approximately equivalent to 30 and 120 characters per second respectively. The final consequence of this feature is the reduction in telephone connect time and associated charges, as the message is formatted off-line at the users convenient speed and style.

Another feature which assists in the efficiency of communications is the ability to create macro commands. A macro is a command or string of commands which may be issued with a single or minimal number of keystrokes. For example, using a particular software package, the command "Check Exchange; Scan Since February 20; read from Counterpoint" can be given using essentially one keystroke. Automatic dialing is also thus enabled as the software can take control of the computer when the communications disk is booted and execute a macro list you have created, including the appropriae telephone number and logon procedures (computer identification, names and passwords). This is an excellent feature where the complexity of the system inhibits a user's access, or where a specific disability reduces keyboard efficiency.

An appropriate modem must also be selected. (Modem is an acronym condensed from two words which describe its function: mo (dulator) and dem (odulator). The modem is the electronic circuitry which acts as a translator between the computer and the telephone network, obvious when the reader recalls that the telephone nework was designed to transmit audible recognizable sounds while the computer utilizes a code

of electrical pulses. The modem simply translates the computer's codes into audible tones which can be sent over the telephone. A receiving modem retranslates these tones into computer code now again comprehendable to the receiving computer. There are essentially two kinds of modems applicable to standard telephone lines, acoustic and direct connect, each having a unique versatility better suited than the other for the user's purpose.

Efficient, effective data transfer requires the assistance of an additional service associated with the modem: a serial interface capacity. It should be known that a computer sends its code around internally on a "bus" of eight, 16 or 32 individual "wires" (lines) depending on the capability of the microprocessor. One character of code consists of "ones" or "zeros" travelling parallel to each other across this "bus" of wires. To send messages using this method of information transfer would require an equivalent amount of telephone wires, which is obviously impractical. Therefore, the computer requires a "serial interface" which converts the character codes that travel beside each other (parallel) to "single file" (serial), and codes can

travel down a single wire (even though it slows their travels slightly). Serial interfaces may be integrated as part of the modem or may be on a separate card installed in the computer.

Information Utilities

The above hardware software acquisitions on hand, the microcomputer user is now linked to the world, and has a large array of information bases to tap which are commercially available at variable rates depending on subscription fees and connect time.

Two of the largest information utilities (Johnson, 1984) of interest to those in the educational community generally are DIALOG's "Knowledge Index" (24 databases) and BRS (After Dark) which permits access to 36 databases. Some of the databases included are the following:

- ERIC (Educational Resources Information Center, Bethesda, MD)
  ERIC has more than 1/2 million entries and includes approximately 32% research and technical supports, 20% conference papers, 11% project descriptions, and 11% guides. It

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is a rich resource for special education searches of numerous kinds.

- ETSF (Educational Testing Service Test Collection, Princeton, NJ)
  ETSF describes more than 5,000 test materials and evaluation tools of all kinds.
- ECER (Exceptional Child Education Resources, Reston, VA)
  ECER lists journal articles, curriculum materials, texts, program descriptions, conference papers, and dissertation citations of interest to any area of exceptionality.
- RICE (Resources in Computer Education, Portland, OR)
  RICE collects information on all aspects of educational computer applications, including software evaluations.
- COMPUSERVE (CompuServe Information Service, Columbus, OH)
  COMPUSERVE offers a wide collection of information through knowledge categories such as financial, electronic encyclopedia, shopping, banking and text editing: MECC (Minnesota Educational Computing Consortium)

software catalogs, as well as the last five year acquisitions of ERIC (noted earlier) can be accessed through COMPUSERVE.

- THE SOURCE (McLean, VA)
  The source offers over 700 programs in an easily accessed menu-driven format which includes news, business services, entertainment, travel, word processing, and the like.

Almost 350 "data repositories" accessible by a microcomputer and modem, containing over 2400 files, are presently in existence. While commenting that present subscription rates vary from a $35 subscription fee to thousands of dollars, one author (Lisanti, 1984) noted that on-line searches are becoming progressively less expensive as major information utilities introduce low cost subscriptions to the most utilized bases.

Further, "front end search software" can be utilized to permit off line search entries, and automatic searching, downloading, and logging exits. Software examples to accomplish this include, In-Search (Menlo Corporation) and Search Helper (Information Access Company) amongst others.

Finally, gateway systems such as Easynet provide the user menu-driven systems to access databases such as Dialog with minimum computer skill proficiency.

Of special interest to the reader is SPECIALNET, an electronic mail and bulletin board service targeted specifically to those involved in all aspects of special education. At our last count, SpecialNet had almost 2,000 individual and agency subscribers, the great majority residing in the United States. The [illegible] one of the first Canadian subscribers.)

Developed by [illegible]DSE (The National Association of State Directors of Special Education), SPECIALNET (Snodgrass & Campbell, 1982) had almost thirty boards or information bases. These include technology areas (eg. computer application), program areas (eg. early childhood, deaf), special education management (eg. litigation), and special purpose boards (eg. CHAIN - a parent oriented information base.)

SpecialNet offers numerous information access and communication potentials for the subscriber interested in special education. The author employs Specialnet information to enhance university course instruction as well as to provide consultation assistance to the Prairie Post bulletin board subscribers.

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Further, the mail feature of SPECIALNET allowing message composition and retrieval places one in instant direct contact with resource personnel.

It is important for readers to note that these information services can all be reached independently should the user be prepared to incur the long distance charges involved. Of special interest to those living in relatively-isolated areas, however, is the provision of inexpensive digital transmission through packet switched networks made available by telephone consortiums. For example, TELENET in the United States and DATAPAC in Canada can be accessed through one of many "pads" (packed assembler-disassembler) usually located in a larger urban community. Subscribers are therefore able to reduce expenses by unobtrusively sharing common digital telecommunications circuits because telecommunication circuits can carry a vast amount of information concurrently.

RSEOP: The Rural Special Education Outreach Project

The Rural Special Education Outreach Project of the Faculty of Education of the University of Lethbridge (Alberta, Canada) was established in 1981. In that year earmarked time-specific funds were awarded

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from the Department of Advanced Education and Manpower (Government of Alberta) on the basis of a proposal developed by the author. The first phase of the project terminated officially in March (1985), and the details of a three-year extension are now being negotiated.

The RSEOP envisioned its primary responsibility as the upgrading of special needs service delivery in a limited region of the province (Southwestern Alberta) through a two-pronged approach. The delivery of effective but traditional inservice workshops was to be facilitated by bringing experts on-site for focused training. However, the pilot development of a microcomputer lab was added as a secondary thrust. This lab had a limited budget to collect and disseminate hardware and software samples thought to be exemplary. A major aspect of this service was a small bulletin board system enabling a cost-effective alternate communication system for participants.

In the first phase now completed, the project has successfully provided numerous in-service training workshops for rural educators. Our rural-based special education personnel in Alberta share with their rural colleagues elsewhere an inability to effectively

utilize conventional services. Typical rural realities include the complexities of dealing with variables such as small size, geographic isolation, and minimal financial-technical-professional supports. These reduce the impact and effectiveness of many special education undertakings, demand an inordinate amount of energy and finances, and significantly increase the tensions of all parties involved.

Several previous experiences by the author led to the realization that major revisions of traditional rural special education services were in order. For example, the years 1979-81 inclusive provided a study leave opportunity in Europe, an eighteen-month secondment contract to the Canadian National Institute on Mental Retardation, a major consultative experience in support of a revised school act in the Northwest Territories, and a professional tour of New Zealand. All made obvious the tragic disparities enhanced by the physical and geographic isolation of the handicapped regardless of ethnic or national origin. Material poverty and severely impoverished educational opportunities seemed synonomous with the life realities of the rural handicapped population.

To this observer isolation, in both its physical and attitudinal dimensions, was the primary obstacle to overcome if the rural handicapped were to achieve meaningful standards of normalization and integrating opportunities.

To illustrate, the Northwest Territories of Canada in 1984 had only 49,000+ inhabitants spread over 3 1/3 million square kilometers (1,304,900 square miles), a ratio of approximately one inhabitant for every 70 square kilometers. Included in that ethnically diverse population are handicapped individuals disproportionately affected by climatically-induced factors (eg. chronic otitis media) and socially-induced factors (eg. fetal alcohol syndrome). Obviously disserved by traditional institutionalization and consequent severence from family/community ties, such a population requires ingenious and bold innovation if individualized service is to be attained in the home community.

It became obvious to this observer that the handicapped population of Canada, with judicious assistance and vigilant advocacy, could benefit greatly from the advantages of telecommunications technology

discussed in this paper. It is suggested that their peers elsewhere could reap the same benefits.

Accordingly, the author selected to employ the vehicle of the RSEOP to undertake a pilot project in which appropriate alternate technical supports for the traditional menu of supports provided for this population would be examined. An exceptionally restricted budget encouraged creative purchasing decisions, an effort largely simplified but enhanced by the use of Specialnet's electronic mail system to verify the wisdom of hardware/software decisions.

It is fair and appropriate to indicate that the Advisory Committee for the Project were more impressed with the visible collection of a hardware/software library accessible to teaching staff, than to the provision of an information service which lacks concrete reality.

Thus, the commitment to the development of a customized bulletin board system flexible enough to incorporate parents, children, teachers and administrators in its catchment area proceeded unobtrusively at first, supported by the Dean of the Faculty of Education as an expression of commitment to the University's mandate for innovation.

That support enabled the gradual accumulation of a network of cost-free subscribers to the "Prairie Post" (as the RSEOP Bulletin Board was named by its participants). These twenty-five participants accumulated almost one thousand interactions through 107 hours of time, the great majority of these accumulated in the first quarter of 1985.

The RSEOP Bulletin Board System

Objectives:

The RSEOP, under the guidance of R. Gall and F. Isaac (a technically literate graduate of the University of Lethbridge Bachelor of Educatio program) developed a hardware-software acquisition plan which sought to meet the following primary objectives:

1) To develop a physical network of hardware units in the region which would become the RSEOP Bulletin Board, and to establish a communications network between them.
2) To share these units in a pilot phase of the project between selected representations of the teaching and administrative components of the School Systems with in the rural region of

Southwestern Alberta, and to eventually extend these to parents and special needs children.

3) to "broker" information services available on information utilities (such as SpecialNet and BRS-After Dark) on behalf of the RSEOP pilot project participants, and to establish appropriate subscription contracts with these utilities.

4) To encourage the development of a variety of telecommunications applications through the RSEOP network, including electronic mail between participants and externally to the information utilities; consultation services between participants, University personnel, and the information utilities; and electronic conferencing between system participants on matters of common interest.

In order to accomplish these objectives, a number of hardware-software acquisitions formed the central unit of the RSEOP bulletin board system. A bulletin

board program developed by Micro-Data Products (Aurora, CO) was purchased to run continuously on the Apple IIe master unit.

An Apple Super Serial Card acted as the modem interface, and a Hayes Smartmodem 1200 served as the modem, accepting calls at either 300 or 1200 baud rates on a dedicated line (403-329-2738).

The Board utilized two software packages to permit data-capturing capability. Transend enabled auto-dial interactions between bulletin board users and the network. Datacapture IIe provided software enabling message format and transmission.

A Percom hard disk system (10 megabyte winchester drive) enabled the board to incorporate storage that is the equivalent of 19 floppy disks (2000 pages of single-spaced documentation)-- more than adequate for our needs at the time.

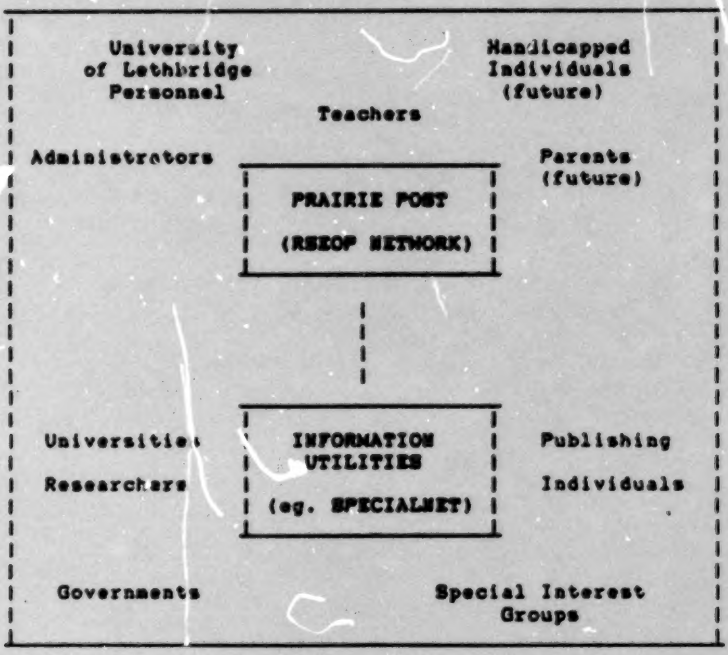
Incoming and outgoing transactions were monitored by the Thunderware "Thunderclock" time card which collated and reported the frequency and duration of all calls. (This function is most important to those considering using toll-free connections to convenience subscribers.)

Each RSEOP external station has the following configuration: an Apple II series computer, double disk drive and terminal, printer, datacapturing program, wordprocessing program, and modem. The last three items are loaned without charge to participants unable to invest in purchase initially.

The BASIC language skills of the RSEOP technician, were utilized to establish seven special function boards: Computer, Precision Teaching, Exchange, Inservice Conference, University, and Adaptive Devices. The content and number of Boards can be expected to be modified substantially in time, should the Project enters its second phase with adequate funding and a clear mandate to provide this type of service.

It should be noted that the general model developed by the RSEOP bulletin board project has been modified in the San Francisco area by a group of handicapped individuals, parents and professional advocates in the Disabled Children's Computer Group sponsored by the Lawrence Hall of Science, Berkeley.

The service configuration of the present RSEOP bulletin board network can be shown as follows:



Readers interested in obtaining more information on developments in all aspects of the RSEOP pilot project are encouraged to write to the RSEOP, c-o University of Lethbridge, 4401 University Drive, Lethbridge, Alberta, Canada T1K 3M4.

Problems Associated With Microcomputer Telecommunicating

Defects are always more tolerable
than the change necessary
for their removal

- Descartes

A somewhat utopian vision of the practical and humanitarian aspects of communication via microcomputer has been presented thus far. It is of value at this point to consider some of the potential factors which might reduce this phenomenal potential.

Several sociopsychological factors might be predicted to emerge as segments of the population gain relatively unlimited access to knowledge.

The handicapped especially stand to gain much through communication enhancement largely because past events have denied them so much. Being handicapped has been synonomous with disadvantage, with reduced power and control. Will the knowledge explosion, now more equitably distributed to the handicapped, lead to greater independence and to greater latitude of choice in making important life decisions? Will the handicapped actually be empowered and politically emancipated through technology? What sociopolitical

changes might accrue as a result of expanded access to information by this subgroup?

Wolfensberger (1972) has argued that both physical and mental abuse have long accompanied the lives of the handicapped, many of whom are devalued and seen as deviant by the dominant culture because they are

> "different from others in one or more dimensions which are perceived as significant by others who value this difference negatively."

Many of his writings identify the specific limitations imposed on the lives of the handicapped as a result of denigration. Wolfensberger also suggests that some individuals and groups benefit, directly or indirectly, from keeping handicapped individuals in positions of dependency. If this premise is correct, what new social inventions in the global village will develop to extend such control over the lives of others into the future?

As suggested by Romich and Vanini (1984, p.77), those who advocate for technological extensions to the handicapped population must be prepared to argue vehemently for equity of access:

> "With all of this exciting technological progress, however, new problems are being created. Now that functional technical aids are available, we must address the task of getting them to the people for whom they have been created. The first aspect of this is that of awareness building. People who need, or who have clients who need, technical aids must become familiar with the capabilities that these systems offer. At the next level, those rehabilitation professionals who select and apply technical aid systems must learn how to do so in a manner that best serves the interests of the client. Finally, funding for technical aids and the necessary corresponding services must become more straightforward. In all of these areas we are making progress, but more work is needed."

It is to be remembered that technology is not seen as a panacea in many circles generally, and in others it is viewed with fear to the point that the term "technophobia" is applied to describe the reaction. It is important for us to recognize the potential that

fear of the handicapped might be enhanced by technophobia in some of the less enlightened amongst us.

Paralleling this extreme position is the more insidious and general anti-innovation stand commonly found in the professional educational community.

Lindsley (1984) has identified that many powerful technologies were resisted by the educational community until the eleventh hour. These included moving pictures (1911), the typewriter (1920), overhead projector (1944), television (1962), programmed instruction (1955-68), and microcomputers (1977). Even today, the mass presence of microcomputers in schools is not a guarantee of their appropriate utilization or equitable distibution to children.

It is widely accepted that the educational community prefers to make haste slowly. For example, a study commissioned by the National Science Foundation in 1973 suggested a time lag of two decades between discovery and implementation of ten major technical inventions (Selback & Hargen, 1984). The recommended remedy in some circles is to call for a moratorium on implementation until every impediment has been overcome. For example:

> For schools to fully determine the applicability of microcomputers to the educational problems of special needs children, a planned change approach to microcomputer implementation must be taken. A critical element of this planned change approach involves the assessment of a range of organizational factors which may be predictive of the effectiveness of a special services microcomputer program. (Bellenbach & Hargen, 1984, p.92).

These authors then provide an evaluation plan that includes an analysis strategy of eight educational organization factors - ability, values, information, circumstances, timing, obligation, resistance, and yield - which must be identified and encountered.

It is hard to argue with the wisdom of such an approach, and in fact Bellback and Hargen's plan should be widely examined. At the same time, waiting a decade or two to apply and enhance present technology that today can enrich the communication options of the handicapped is to deny the population a multitude of life-supporting experiences. Catholic theologians would call this a "sin of commission".

Microcomputers have already demonstrated their ability to support improved initial learning and transfer of knowledge organized and delivered by competent teachers. Microcomputer-based telecommunications can widely expand that potential if we are prepared to examine a new set of human relationships occasioned by significantly altered modes of communication:

> It would be a very serious error to look only at the technical aspects ... It is only in the context of a supportive educational community - a human environment conducive to learning - that the hazards ... can be avoided.
>
> We must take it as our goal to draw people into an intimate and creative human context. The people who are on the receiving end of the innovations have to be involved in the transition. (Chorover, 1984, p.226).

These issues, brought to the surface by technological innovation, must be addressed by the educational community at large, if a significant redesign of human potential is sought.

Future Directions of the RSEOP Network

To prophesy is extremely difficult,
especially with respect to the future
- Chinese Proverb

At the time of writing (March, 1985), the RSEOP was at the end of its first phase; negotiations are underway to determine the nature and extent of a three-year project extension announced generally by government funding authorities. Accordingly, what follows represents the vision of the author only.

Could that vision prevail, the RSEOP will attempt an extension into at least three areas - relexive communication, pre-school intervention, and precision teaching.

Reflexive Communication

An interesting application of telecommunications is provided by an ongoing experiement with gifted children in Montreal entitled "reflexive communication" (Brennan & Spriggs, 1984). In an attempt to motivate gifted students to acquire computer-based skills and to share ideas, this project enabled them to develop joint projects concurrently over distance as computers linked by modems share the same program. Using Radio Shack

Duofone telephone amplifers (which enable hands-free voice contact) to supplement the data exchange on the computer, these students actively edit and modify documents of their own design. Of special interest is the fact that the hardware system required is readily available - two computer stations with Apple IIs orII+ or II+compatible computer, monitor, and one or two disk drives. The software required is equally common and relatively inexpensive - a communications program permitting transfer of any DOS file (DFX-II) a word processor program (Bank Street Writer) and additional software permitting presentation of experimental data (Visicalc) and graphic data (Visiplot).

While this project is presently limited to gifted students, the processes it identifies has a wide generic application to many special needs students. The Montreal project will be monitored and hopefully initiated in the RSEOP region.

Pre-School Intervention

The development of electronically-enhanced learning environments for children who are excluded from formal learning environments by virtue of age and severe developmental handicaps will remain an interest

of the author. Interactions between parent-consultants would be developed through the RSEOP Bulletin Board system, and would focus on five developmental areas for intervention: language comprehension, language expression, problem solving, social/personal interaction, and motor behaviors. (Behrmann, 1984)

Precision Teaching

The RSEOP has a strong commitment to the application of a specific data-based instructional format known as Precision Teaching developed by Ogden Lindsley. For the past decade, intensive in-service training efforts have occured, and many teachers employ the curriculum system and its rate sheets as a part of the Language Arts and Mathematics programs in the elementary schools of this region.

The use of the RSEOP system to upload and download Precision Teaching data and thereby to permit the transference of data-based curriculum decisions is expected to continue. AIMSTAR software (developed by Hasselbring-Hamlett of Vanderbilt University), and the RATE-SHEET DISK developed by F. Isaac of the University

of Lethbridge are examples of software developed to enhance Precision teaching activities that can be utilized on the Prairie Post bulletin board.

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APPENDIX

Glossary Terms

Access: Used either as a noun or verb to indicate either gaining control of a system or the acquisition of data from a storage device or peripheral unit.

Acoustic Coupler: A data communications device that converts computer data into audible tones for communication over telephone lines. (The part of the modem that transmits data to the handset of a common telephone, but not the modem itself. The telephone handset fits into special rubber cups for transmissions of data.)

Adaptive Firmware Card: A plug in card for the Apple, produced by Adaptive Peripherals, that allows a disabled user to bypass the keyboard and enter information on the computer with a variety of single and multiple switches, scanning techniques, Morse Code, and others.

Alphanumeric: Data that consist of letters and numbers.

Artificial intelligence: An area of study aimed at developing machines that "think" like humans. Pretty much a buzzword.

ASCII: An acronym for American Standard Code for Information Interchange. It is an international standard that defines how characters are represented in a computer's storage.

Asynchronous: Participants in a computer network do not need to be present at the same time to interact. The store and forward features of the computer permit users to access information and messages at their convenience.

Basic: Beginner's All-purpose Symbolic Instruction Code. A programming language designed for easy use.

Baud: A measurement of communications speed between devices. Baud can be roughly translated into characters by dividing by 10: 1,200 baud is 120 characters a second.

Bit: A contraction of binary digit (1 or 0). A bit is the smallest unit of information in a digital computer.

Booting (or bootstrapping): A term for loading a program - usually the operating system - into a computer.

Buffer: A temporary storage area for holding computer data until they are processed by another device. It is needed because the data can flow at different rates between a computer and its peripherals.

Bug (debug): A problem or mistake, usually in the software. Debugging is the process of correcting it. The term dates from the days of primitive computers, when the vacuum tubes attracted insects that caused short circuits.

Bulletin boards: Systems on computer networks where computer users can deposit and read messages.

Bus: A set of electrical circuits into which other circuit boards can be plugged.

Byte: A unit of computer memory, made up of a series of bits. One byte will store one number, letter, character or space. Bytes are normally measured in groups of 1,024 which are designed by a "K". The "K" (bytes) a computer has, the more memory it has.

CAI (Computer assisted instruction): Instructional materials and tutorial programs presented via a computer. The application usually involves a dialogue between the student and a computer program which informs him-her of mistakes as they are made.

Carrier services: Communication services available on the networks of authorized common carriers (that is, telephone company network services).

CBMS: Computer-based message system.

Coaxial cable: An insulated, central conducting wire wrapped in another cylindrical conducted wire and enclosed in a protective cable. Coax can carry large amounts of information and is used to hook computer terminals together.

Compatibility: The ability of two devices to work together. In addition, if a program can be run successfully without alteration on two different computers, then the computers are generally said to be compatible.

Courseware: Software written for educational purposes.

CP/M: Control program for microprocessors. A disc operating system for micros developed by Digital Research Inc.

CPU: Central processing unit. The part of the computer containing the circuits that interpret and execute instructions.

Crash: What happens when a computer becomes inoperable because of a hardware malfunction or software error.

Cross talk: In telecommunications, the unwanted transfer of energy from one circuit to another.

Cursor: An indicator on a video display screen that shows where the next character will be typed.

Daisywheel printer: A printer where the type head is circular, with the characters attached to it on the ends of stalks. It prints fully formed characters and is usually used with word processing systems.

Data base: A store of interrelated data on files, for use in an information retrieval system.

Data communications: The transfer or exchange of information between computers, requiring the transmission of digital signals.

Disc (disc drive): A disc is a circular plate coated with magnetic material on both sides to store information. For data retrieval, it is rotated inside a disc drive. It can be floppy (flexible) or hard.

Disc operating system (DOS): A computer program responsible for the housekeeping and communications functions needed to get the disc storage system and main computing unit to work together. DOS also handles communications with other peripheral devices.

Diskette: Normally refers to a 5 1/4-inch floppy disc.

Download: To transfer data or programs from a remote location into a computer. Sending to the remote location is called uploading.

Dumb terminal: A terminal with no independent processing capability of its own. It only works when connected to a computer. A smart terminal, by contrast, has some data processing capability. An intelligent terminal can be used for local processing without connection to a central unit.

Duplex (full duplex): The ability of two devices to transmit simultaneously and separately along the same communications channel. Half-duplex designates the ability of devices to transmit in both directions, but not at the same time.

Electronic mail: A general term for the electronic distribution of messages that can be stored for reception or reading at a later time.

Emulator: The act of imitating or performing as if a device or program were something else. An emulation program permits a computer to imitate another brand or type.

End user: The user who ultimately receives computer service or information.

Expert system: A development of artificial intelligence. The effort to have a computer contain specialized knowledge and mimic the thinking of a human expert.

External memory: A device or series of devices capable of storing information that expands a computer's internal, or main, memory.

Fibre optics: The use of glass fibres of very small diameter to transmit information via light waves.

File: A collection of similar data, or a group of related records, treated as a unit.

Floppy disc: A disc made of flexible magnetic material, housed in a cardboard envelope. It usually refers to an eight-inch-diameter disc. There are minifloppy (5 1/4 inches) and microfloppy (three to four inches) discs.

Gateway: A point in a communication network that has a high density of use and equipment and that provides a link between two or more networks. Telephone companies also provide gateway services so that users can access different data bases with one access code and terminal.

Hard copy: Text and graphics printed out on paper.

Hard disc: A disc made of rigid, ceramic-like material with a magnetic coating. It stores much more than a floppy disc; an eight-inch hard disc for personal computers can store up to 100 million characters. There are 12-inch and 14-inch discs for larger computers.

Hardware: The physical components of a computer system.

Informatics: The collection of technologies involved in handling information by computer.

Information centre: A large computer that serves data processing needs, as well as the main memory and controller of decentralized terminals and smaller computers in a network.

Information provider: An individual or organization that provides information for a data base.

Integrated software: A collection of computer programs that are interactive. For example, data can be transferred from one to be used in another.

Interconnect: Organizations other than regulated telephone utilities that supply telephone terminal equipment. The term also refers to the regulatory decision permitting customer ownership of telephones.

Interactive: The use of a computer, or other device, in such a way that the operator (computer user) is in control of its activity. An interactive system may also be conversational, implying continuous dialogue between the user and the system.

Light pen: A hand-held light source that is connected to a cathode ray tube. When it is pointed at the tube, the position of the light spot is sensed and images can be created, moved or deleted.

Local area network (LAN): A communications system that allows several information processing devices to link with one another for a limited distance, such as within a college campus.

Main memory: The computer's internal memory, also known as RAM or core memory. It is volatile, which means the contents will be destroyed if power is lost.

Mainframe: Any large computer.

Menu: A list displayed on a terminal describing functions a user can choose.

Microcomputer: A desktop computer that uses a single chip, the microprocessor, as the central processing unit.

Minicomputer: A computer of intermediate size and computing power between a mainframe and a microcomputer.

Modem: A contraction of modulator-demodulator, a device that translates computer data into pulses that can be transmitted over telephone lines or optical cables.

Multi-tasking: The computer's ability to do more than one job or program at the same time.

Network: A system consisting of a computer and its connected terminals and devices. Computers can also "network" with each other.

Noise: The unwanted electronic signals in telecommunications.

On line: Refers to equipment that can interact directly with a computer's central processor.

On-Line Services: Usually a term to describe a company that provides information searching services for a fee, available over telephone lines to a computer.

Operating system: The set of programs that make it easier to operate the computer. It acts as a kind of traffic cop, directing tasks such as input and output between the computer and its peripherals, or accepting and interpreting information entered through a keyboard.

Optical fibre: A very thin, flexible fibre of pure glass that transmits pulses of light from a laser or light emitting diode. It can carry much more information than copper wire.

PABX (PBX): A private automatic branch exchange is a switching system within a company that also has access to the public telephone network. If it is operated manually, it is a PBX.

Packet switching: A method of data communications in which the message is split up into smaller units, transmitted and reassembled at the other end. Each packet may be sent by a different route.

Peripheral device: A device that attaches to the computer, such as a disc drive, terminal or printer.

Protocol: A format of communications for information exchange.

RAM: An acronym for random access memory, also known as internal memory. It is memory that can be altered by writing over previous contents. RAM is volatile and the contents will be destroyed if power is lost.

ROM: An acronym for read-only memory. ROM is a form of internal memory or chip on which the commonly used programs are permanently placed to be ready by the computer.

RS-232: An interface standard for asynchronous data communications between any two devices.

Software: The collections of instructions or programs that direct a computer's operations.

Stand-alone: A device that is self-contained, not dependent on another unit for memory or processing.

Supercomputer: A very fast, high capacity mainframe used for highly complex, rapid calculations such as those for weather forecasting or oil reservoir modelling.

Supermicrocomputer: A high-end microcomputer, usually with a 32-bit microprocessor, that has power comparable to that of the larger minicomputers.

Teleconferencing: A general term for conferencing that involves telecommunications links. It includes: full-frame videoconferencing, where people can see and hear participants at other locations; audio teleconferencing; slow scan and freeze-frame image transmission.

Teletext: A one-way, non-interactive system that transmits information through regular or cable TV broadcast signals or through FM radio signals to an adapted TV set.

User-friendly: An overused buzzword, referring to a system that relatively untrained users can operate easily. It should be replaced by "easy to use".

Paper presented at the Annual Convention

of the

Association for Children and Adults with Learning Disabilities

(22nd, San Francisco, CA, February 20-23, 1985)

Videotex: A two-way information system that uses television sets or special terminals. Information is displayed with text and graphics.

Winchester disc: A very common type of hard disc. Supposedly so named because International Business Machines Corp., which developed the technology, used the product code 3030, recalling the Winchester rifle.

Windows: Software that allows the user to see several functions at once on a single screen - the screen is partitioned.

Word processor: A computerized system or program used for writing.

X.25: The international standard for packet switched data networks. The protocol was developed by Bell Canada and approved in 1982 by members of the international telecommunications standards body.